EARTH SURFACE DYNAMICS

U.S. GEOLOGICAL SURVEY

U.S. DEPARTMENT OF THE INTERIOR

BEFORE THE SENATE COMMITTEES ON

COMMERCE, SCIENCE AND TRANSPORTATION

AND

FOREIGN RELATIONS

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Thank you for the opportunity to address you and the committees on the issue of U.S. Geological Survey (USGS) activities related to the International Polar Year (IPY). My name is Thomas Armstrong, and I am the Program Coordinator for the Earth Surface Dynamics Program at USGS. I also represent USGS and the Department of the Interior (DOI) on the Arctic Council's Arctic Monitoring and Assessment Program's Climate working group, and activities related to the Arctic Climate Impact Assessment.

Background

The USGS serves the United States by providing reliable scientific information to describe and understand the Earth, minimize loss of life and property from natural disasters, manage water, biological, energy, and mineral resources; and, enhance and protect our quality of life. It is within the spirit of this mission that the USGS has developed plans for participation in the International Polar Year, working with partners in DOI, with other Federal and State agencies, and with scientific colleagues around the world.

The IPY will extend from March 2007 through March 2009. This period will commemorate the fiftieth anniversary of the 1957–1958 International Geophysical Year. The IGY, as it was called, was modelled on the International Polar Years of 1882-1883 and 1932-1933 and was intended to allow scientists from around the world to take part in a series of coordinated observations of various geophysical phenomena. The work of scientists from over 60 countries literally spanned the globe from the North to the South Poles. Although much work was carried out in the arctic and equatorial regions, special attention was given to the Antarctic, where research on ice depths yielded radically new estimates of the earth's total ice content. In a similar spirit of discovery and understanding, IPY '07-'09 is envisioned as an intense scientific campaign to explore new frontiers in polar science and to improve our understanding of the critical role of the polar regions in global processes. Most significantly, IPY is envisioned as an opportunity to engage the public in polar discovery and help attract the next generation of earth scientists.

Within current funding amounts, the USGS will participate in the IPY through extension and enhancement of programmatic activities in research, assessment, and monitoring in the Polar Regions that support the scientific mission of our organization and address the themes and goals of the IPY. These activities span the biologic, geologic, hydrologic, geographic, and information sciences and will include but not be limited to:

- Research and monitoring of the status and distribution of fish, wildlife and vegetation; determination of species at risk; permafrost evaluation to include assessment of changes in the thermal regime and feedbacks with the changing climate, organic carbon characteristics and distribution; evaluation of hydrologic inputs to the carbon budget- including the influence of large river deltas on carbon flux to the marine system, snow and water-borne contaminants and freshwater inputs; and the evaluation of surficial and geochemical processes in understanding the changing polar environment.

- Integrated monitoring for assessing the relationship between major stressors, like climate change, and regional changes in the carbon cycle of Arctic watersheds; ground and satellite-based monitoring of glaciers and icecaps for volumetric changes and monitoring of thermal changes in permafrost; reconstruction of past climate cycles and evaluation of current changes from sediment and ice core records; monitoring and assessment of changes in rates of coastal erosion and surficial processes; evaluation of changes in status and distribution of circum-polar vegetation, fish, and wildlife and freshwater discharges in the Arctic.

- Evaluation of the nature of arctic/boreal hydrologic interactions and the relationships between climate and plant growth, productivity, permafrost depth, and resulting effects on nutrient availability and atmospheric heat sources and sinks.

- Establishment or extension of permanent monitoring infrastructure for permafrost, global seismicity, and geomagnetic activity. Assessment of energy resources in the circum-arctic area including oil, gas, coalbed methane and methane hydrates.

- While the USGS will not conduct specific social science research as a part of IPY, several of our studies will have implications for populations living in the Polar Regions. These include our energy and mineral assessments, especially studies of coalbed methane potential for providing energy to isolated communities; natural hazards monitoring; studies of scour modelling due to changes in hydrology and their impacts on manmade structures; and 3-dimensional assessments of changes in permafrost that may have serious impacts on arctic road networks and other forms of infrastructure.

- An additional element will include the production of geospatial information related to high-resolution elevation data and digital ortho-imagery for Polar Regions of Alaska and the development of an IPY portal on the USGS public web site. The portal will provide one-stop access to USGS science data sets; information products (e.g., maps and reports); educational resources for teachers;

and tools and applications (e.g., geospatially referenced index of pertinent data, bibliography of key references, scientific collaboration tools). The USGS IPY portal will be linked to Geospatial One-Stop (www.geodata.gov), in order to leverage geospatial data and tools available from other agencies and organizations.

Beginning with the very first geophysical and geological surveys carried out in Antarctica over a half-century ago, the USGS has maintained a long tradition of scientific monitoring, assessment, and research in the Polar Regions. The USGS has an extensive history of activities including topographic mapping and geodetic control in Antarctica, satellite and ground-based monitoring of glaciers and ice caps, research on movements, distribution patterns and adaptation of polar wildlife, operation of a seismic array at the South Pole, estimations of energy resources of the circum-Arctic, mapping of the distribution of circum-arctic vegetation, and the development of paleoclimate records from Alaskan sediments and polar ice cores.

USGS participation in the International Polar Year allows the agency to celebrate this enduring tradition with the global polar research community and to renew our commitment to polar science at a time when the eyes of the world are focused on these fragile regions.

Numerous USGS programs are involved in research, assessment, and monitoring in the Polar Regions that support the scientific mission of the USGS and the Department of the Interior, and address the themes and goals of the IPY. Some of these specific activities and related products are listed below.

1. **Research and long term monitoring of the polar regions**

   Products and activities include:

   - **Satellite Image Atlas of Glaciers of Asia, Alaska, and Iceland**
     http://www.glaciers.er.usgs.gov/html/chapters.html

     Glacial ice distribution, including major ice sheets in the arctic, subarctic, and Antarctic, are critically linked to water availability for both human and ecological needs, as well as changes in sea-level worldwide. Changes in these ice masses therefore have global-scale ecological and socio-economic impacts. Over the last several decades, the majority of the world's glaciers have decreased in size and volume. These images, part of a worldwide series, will help in assessing the current distribution of glacial ice and rates of glacial ice retreat worldwide.

   - **State of the Earth's Cryosphere at the Beginning of the 21st Century: Glaciers, Snow Cover, Floating Ice, Permafrost and Their Impacts on Indigenous Marine Mammals**

     The USGS has been monitoring permafrost temperature in the Arctic; three Benchmark Glaciers for climate change, glacier geometry, glacier mass balance, glacier motion, and stream runoff; and marine mammals for

many decades. The results of those monitoring efforts will be examined, analyzed and reported on during the IPY.

- **Yukon River Basin – Rates and Effects of Permafrost Thawing in the Arctic**

  USGS scientists and managers are working with a consortium of U.S. and Canadian Federal, State, and Provincial agencies, university scientists, and tribal organizations to initiate a major project to understand and predict climate-induced changes to the air, water, land, and biota within the Yukon River Basin. This collaborative scientific effort will provide a benchmark for tracking and understanding changes occurring throughout the Arctic and Sub-arctic region to biological communities, stored carbon, the water cycle, and human infrastructure as a consequence of climate-induced permafrost thawing and landscape change.

- **Petroleum Resource Assessment of the Arctic**

  The USGS World Petroleum Assessment of 2000 estimated that a significant portion of the remaining oil and gas resources of the world reside in the Arctic. This follow-on study will examine Arctic basins in more detail and report on oil and gas resource potential of unexplored basins. The initial results should be completed during the IPY.

- **Landsat 7 Image Map of Antarctica (LIMA)**

  The LIMA will create three high-quality remotely-sensed mosaics of Antarctica from more than 1200 Landsat scenes in cooperation with the British Antarctic Survey. This work is also funded by the National Science Foundation.

2. USGS Facilities and Resources for Arctic and Antarctic Research

The USGS includes numerous facilities throughout the United States and Antarctica that are focused on activities that directly link to the International Polar Year. These facilities include:

- **U.S. National Ice Core Laboratory, USGS, Denver, CO**

  The U.S. National Ice Core Laboratory (NICL) stores, curates, and facilitates study of ice cores recovered from the polar regions of the world. It provides scientists with the capability to conduct examinations and measurements on ice cores, and it preserves the integrity of these ice cores in a long-term repository for current and future investigations. Ice cores contain an abundance of climate information, more so than any other natural source of climate information such as tree rings or sediment layers. http://nicl.usgs.gov/

- **U.S. Antarctic Resource Center, USGS, Reston, VA**

  The U.S. Antarctic Resource Center (USARC) is the Nation's depository for Antarctic maps, charts, geodetic ground control, satellite images, aerial

photographs, publications, slides, and video tapes. These resources are items produced by Antarctic Treaty parties in support of their activities in Antarctica and provided to the USARC in connection with a resolution of the treaty providing for exchange of information. http://usarc.usgs.gov

- **USGS Alaska Science Center, Anchorage, AK**

  The USGS Alaska Science Center is a Center of Excellence for the Department of the Interior to address important natural resources issues and natural hazards assessments in Alaska and circumpolar regions through long-term data collection and monitoring, research and development, and assessments and applications. Their mission is to provide scientific leadership and accurate, objective, and timely data, information, and research findings about the earth and its flora and fauna to Federal and State resource managers and policy makers, local government, and the public to support sound decision making regarding natural resources, natural hazards, and ecosystems in Alaska and circumpolar regions. http://alaska.usgs.gov/index.php

- **McMurdo Long Term Research (LTER) Program**

  The USGS provides cooperative support to the McMurdo Long Term Research program for water resources data collection and related activities. The support provided is in the form of field assistance, guidance, and review of surface-water data collection by INSTAAR and University of Colorado researchers in the McMurdo Dry Valleys (Taylor Valley and Wright Valley) of Antarctica. Cooperation is also provided in the form of guidance and support for and access to USGS databases and streamflow-records processing applications.

- **Antarctic Seismic Data Library System (SDLS)**

  The SDLS is an Antarctic Treaty effort under the auspices of the Scientific Committee on Antarctic Research (SCAR) to collate and make openly available for research purposes all marine multichannel seismic reflection data (MCS) acquired in Antarctic regions (i.e., south of 60 degrees South). The SDLS was implemented in 1991 under USGS sponsorship, but since about 1996, the SDLS has been run jointly by USGS (with National Science Foundation –Office of Polar Programs and USGS funding) and Osservatorio Geofisico Sperimentale (OGS, Trieste, Italy). The seismic library has branches in 10 countries, with two branches in the United States. The MCS data are sent to the SDLS by data collectors, put onto CD-ROM and distributed to SDLS branches where they can be viewed and used under the SDLS guidelines specified in SCAR Report #9 (and addendums). To date, 60 CD-Roms holding more than 120,000 km of stacked MCS data have been produced for SDLS branches.

- **Web-enabling the US Antarctic Photography Collection from the USGS Earth Resources Observation Science (EROS) Center**

For more the 30 years, it has been USGS's privilege to archive and serve the US Antarctic Program, the international Antarctic research community, and the public with access to the US Antarctic aerial photography collection held at the USGS Center for Earth Resources Observation and Science (EROS). This collection consists of an estimated 400,000 frames of historical aerial photography dating back to the 1940s. This collection is the best collection of Antarctic aerial photography held by any country and its value to the Antarctic research community will only increase with time as work and research continues in Antarctica.

However, neither online metadata, browser images, photographs, nor film products are available via the Internet for the US Antarctic Program Antarctic aerial photography collection. New technology and improved digitizing methods have made it possible to digitize the original aerial film rolls creating browse and medium resolution images of each frame. We propose to link the digitized USAP aerial photography browse and medium resolution image files to the USARC paper map-line plots and web-enable the digitized collection in such a way that users could download images over the Internet at no cost to the user. Implementation of the proposal will result in an integrated on-line query, browsing and delivery capability for all historical USARC photography in the USGS EROS Center.

- **Antarctic Geographic Place Names**

  The USGS operates the U.S. Board on Geographic Names (USBGN) conjointly with other Federal agencies. In accordance with recommendations of the Advisory Committee on Antarctic Names (ACAN), the USBGN approves all new names to be used Antarctica by the United States government.

In addition to work being done by the USGS, other agencies within the Department of the Interior are planning to carry out activities incorporating International Polar Year components. Most notably:

- **Fish and Wildlife Service Initiatives with the Arctic Council**

  The U.S. Fish and Wildlife Service (Service) is the lead agency for the Conservation of Arctic Flora and Fauna Working Group (CAFF) of the Arctic Council. As a contribution to the International Polar Year, the Service has taken a lead role in the international development and implementation of the Circumpolar Biodiversity Monitoring Program, which will serve to guide and coordinate monitoring activities in the Arctic region, facilitate common methodologies and address gaps in existing data on status and trends. In addition, the Service, in cooperation with representatives from other Arctic countries, will convene an international group of experts to develop an action plan for mapping the boreal forest, a northern ecosystem critical to migratory birds and other trust species. The Circumpolar Seabird Information Network, another new

initiative led by Service (and approved as well as jointly funded by the Arctic Council countries), will greatly expand the international knowledge base of the Arctic Region, and it ability to address issues regarding bird species of conservation concern.

- **Minerals Management Service Research**

  The Minerals Management Service will continue its innovative mission-focused environmental and sociocultural research in and around the Beaufort-Chukchi Seas area of the Arctic to support management and development of offshore gas and oil resources. Research planning activities for FY 2007 – 2009 include collaboration with the National Oceanographic Partnership Program, individual agencies and research scientists to incorporate IPY components when feasible. Plans include studies of marine mammals and birds and their ecosystems, mesoscale meteorology, river plume transport processes, ocean circulation, sea-ice modeling and potential collaboration with the developing arctic component of the Integrated Ocean Observing System (IOOS).

This concludes my testimony. My intention was to leave you with an accurate portrayal of just some of the Department of the Interior's many science, monitoring, and assessment studies and related support infrastructure that are firmly within the scope and spirit of the International Polar Year. I thank you for the opportunity to speak with you today, and I look forward to answering any questions that you may have.